Remarks

Claims 1, and 3-10, 12-14, 18-19, 22, 30-48 are pending in the application. The Commissioner is authorized to charge any requisite fee associated with this paper, or credit any overpayment, to Deposit Account 20-1507. In the event a Petition for an extension of time is needed, this paper is to be considered such a Petition.

Obviousness-Type Double Patenting

Applicants acknowledge, with thanks, the withdrawal of the obviousness-type double patenting rejection over U.S.S.N. 09/896,961.

Rejections Under 35 USC 103

The Examiner rejected claims 1, 5-10, 13, 14, 22, 30, 32, 34-36, 38, 40-42, 46-48 under 35 USC 103 as being unpatentable over Pinnaivia, U.S. Patent No. 6,016,632 in view of Clarey, U.S. Patent No. 6,050,509. Applicants respectfully traverse this rejection.

Pinnavaia's invention and focus relate to the intercalation of clays (in their acidic form) with certain electrically neutral, organic, and basic "curing" agents, and the subsequent reactions of those intercalated clays with monomers to initiate polymerization/curing, to produce a large genus of nanocomposites comprising "cured" thermoset polymers, such as polyurethanes, polyureas, polysiloxanes, and alkyds (*see* column 10, lines 23-36). In a single paragraph in column 11, Pinnavaia also states that "All thermoplastic polymers can benefit from the disclosed technology." Pinnavaia then enumerates a list of 19 types of thermoplastic polymers to which his clay/intercalated curing agent technology might apply, of which one type is polyamide polymers as recited by Applicants' pending claims.

Pinnavaia does not teach the benefits of using low quartz clay in the nanocomposites of his invention. In fact, Pinnavaia provides only a single example which serves to teach away from the use of low quartz clay. Example E2 mentions, in a single sentence, removal of quartz from clay. The relevant sentence reads, "The Na+ montmorillonite was purified by sedimentation to remove quartz and other dense, large grain contaminants." Example E2 describes an unsuccessful attempt to prepare a nanocomposite via Pinnavaia's technology from a Na+ montmorillonite clay, in which "There was no observable intercalation of the clay by the curing agent and epoxy resin." The only quartz removal process mentioned in Pinnavaia is

sedimentation "to remove quartz and other dense, large grain contaminants." One of ordinary skill could not reasonably infer from this sentence that sedimentation removed or even minimized small grains of quartz, or that any particular percentage of quartz removal was obtained or will consistently be obtained, especially in view of the highly variable compositions of natural clay samples.

The Office Action relies on Pinnavaia to teach the nanocomposites of the present invention by (1) selecting the polyamides from the generic group of thermoplastic polymers, which Markush group is provided in only one paragraph of the entire disclosure, and (2) combining that selection with a single sentence from Example E2 regarding sedimentation of a clay sample to "remove" quartz .

The Examiner maintains that the difference between the present invention and the prior art of Pinnavaia is the explicit recitation of the numerical ranges for the quartz impurities in the clays. For this, the Examiner relies on Clarey.

Clarey is cited to demonstrate a method for purifying the clay component. In Clarey all types of impurities are removed from the clay material, including quartz. Although Clarey discloses a range of less than 5% impurities, including quartz, for polymer-grade clays, nowhere does Clarey suggest using such purified clays in the process of Pinnavaia or in the process of the present invention. In fact, Example E2 of Pinnavaia was unsuccessful in its attempt to employ low quartz clay in Pinnavaia's curing agent technology, which would tend to lead one of ordinary skill away from attempting to apply Clarey's teachings to the present invention.

Further, in Example E3 of Pinnavaia, a "purified" Na+ montmorillonite clay was treated with NH_4^+ cations, which were then intentionally thermally decomposed to produce an acidic form of the clay, then the clay was used in Example E4 to prepare "a conventional clay-epoxy composite." In Example E5, an example of an epoxy composition was prepared using the Pinnavaia "curing agent" technology and was compared with an epoxy-clay composition prepared from a Na+ montmorillonite clay that had been intercalated with alkyl ammonium ions. There is no indication in Example E5 as to whether the clays were "purified," and it is noted that the presence of the alkyl ammonium in clay gallery of the comparative sample "decreased the effectiveness of the clay reinforcement."

Applicants maintain that one of ordinary skill in the art would not read this sequence of examples in Pinnavaia and interpret them as teaching or suggesting the importance of "removal of quartz," or that "complete removal of quartz" was a significant part of Pinnavaia's technology. Moreover, this sequence of examples provides no suggestion or motivation to modify Pinnavaia's examples or technology to achieve any particular low total concentration of quartz such as the "less than about 2% by weight of quartz" recited by Applicants' claims, especially in view of the negative results obtained in Examples E2 for the Na+ montmorillonite clay nanocomposite, and the alkyl ammonium ion intercalated clay of Example E5.

The Examiner's rejections rely on combining Clarey with Pinnavaia to provide Applicants' claim limitations regarding "less than about 2% by weight of quartz." Clarey describes a method for purifying clays to remove a variety of impurities. Although Clarey suggests that any clay can be purified, at column 3, line 60 through column 4 line 11 Clarey *specifically* remarks on the problems encountered in attempts to apply his purification methods to Na+ montmorillonite clays, and suggests such clays be converted to Ca^{2+} clays prior to purification by his method. Thus, one of ordinary skill in the art would have little, or perhaps even negative motivation with respect to the prospect of applying Clarey to modify the disclosures of Pinnavaia's examples, regarding Na+ montmorillonite clays, which themselves contain negative motivations, as described above.

Even if Pinnavaia and Clarey are combinable (which Applicants maintain they are not), Clarey does not provide a teaching or suggestion or any other basis to modify the *epoxy* nanocomposites of Pinnavaia. Thus, Clarey does not remedy the failure of Pinnavaia to teach or suggest the selection of polyamide polymers from any of the many other polymers generically disclosed by Pinnavaia.

Despite the lack of motivation for combining the references, Applicants submit that the amendments made with this Response further distinguish the claims from the prior art. Pinnavaia fails to teach or suggest the particular polyamides recited in the claims, as amended herein. As the teachings of Pinnavaia, alone and/or in combination with the teachings of Clarey, fail to teach the invention as now claimed, Applicants respectfully request withdrawal of this ground of rejection.

The Examiner rejected claims 3, 4, 12, 18, 31, 33, 37, 39, 44-45 under 35 USC 103 as being unpatentable over Pinnaivia, U.S. Patent No. 6,016,632 in view of Clarey, U.S. Patent No. 6,050,509, as applied above, and further in view of Maxfield, PCT/US94/11430. Applicants respectfully traverse this rejection.

The Examiner indicates that Maxfield is cited to show that nanocomposites having smaller particle size can be used for making films and laminates with improved barrier properties. The Examiner indicates that, with the teachings of Maxfield, one of ordinary skill in the art would have been motivated to use silicates with smaller particle dimensions in the nanocomposites of Pinnavaia for the purpose of making laminates having improved gas barrier properties. Applicants note that the reasons provided above with respect to Pinnavaia and Clarey are repeated with respect to this rejection. Applicants submit that the additional reference to Maxfield fails to overcome the deficiencies set forth above. Further, Maxfield provides no additional motivation to combine the references cited.

The Examiner rejected claims 3, 4, 13, 18, 22, 30-31, 33, 37, 39, 44-45 under 35 USC 103 as being unpatentable over Pinnaivia, U.S. Patent No. 6,016,632 in view of Clarey, U.S. Patent No. 6,050,509, as applied above, and further in view of Beal, U.S. Patent No. 5,552,469. Applicants respectfully traverse this rejection.

The Examiner indicates that Beal is cited to show that one or ordinary skill in the art would have been motivated to use oligomers as intercalants for the modified clays of Pinnavaia, while maintaining low quartz content, as disclosed in Clarey. Applicants note that the reasons provided above with respect to Pinnavaia and Clarey are repeated with respect to this rejection, and the teachings of Beal fail to overcome the deficiencies of those references. Applicants further note that Beal fails to provide the motivation lacking in Pinnavaia and Clarey to combine the references to achieve the invention as is now claimed.

In light of the above amendments and remarks, Applicants submit that a complete response to the Office Action has been filed and that the claims are allowable over the prior art of record. Accordingly, Applicants respectfully request that this application be allowed to issue.

Respectfully submitted,

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